

New Delhi Metallo- β -Lactamase 1 (NDM1)



Scanning EM of plasmids isolated from *E. coli* infected with phage λ

What Is It?

The first thing to understand is that NDM1 is NOT a superbug, new or otherwise. It is worse. From an infection control perspective it has the potential to be far more dangerous. Prof Tim Walsh at Cardiff University has warned that NDM1 is “potentially the end” of being able to fight bacteria with antibiotics. This makes effective infection control procedures – especially hand and surface hygiene – more critical than ever. A bacteraemia caused by an NDM1-positive microbe may be untreatable and the possibility of significant co-morbidity or mortality looms large.

The second key point is that all our bactericidal products (FAD, Bacticlean, Bacteria X, Enduro Hand Foam, AntiBak – indeed anything with the bio-tested label) WILL kill any bacterium containing the NDM1 plasmid on contact.

No, Really, So What Is It Then?

Time to brush up your molecular biology, I'm afraid.

Like humans, animals, plants and pretty much all living things, bacteria contain DNA (deoxyribonucleic acid). This is what genes are made of. Genes code the biochemical instructions to make living cells what they are. They instruct an eye cell to be an eye cell, a hair cell to grow a hair, a yeast cell to eat sugar and turn it into alcohol, basically they instruct and control every living process. Think of a gene as being like a long number rather than a chemical – just like a computer programme. That is how a chemical can hold and replicate complex information.

Genes coded in DNA also tell the organisms in BioGD how to make the enzymes that digest fats, oils and greases.

In the case of 'superbugs' genes instruct the bacterium how to deal with common antibiotics. For example, penicillin will kill a bacterium unless the bacterium contains a gene that tells it how to deal with

a penicillin attack. It's very much like having anti-virus software – in this case the bacteria has the genetic 'programme' that tells it how to deal with penicillin.

NDM1 is a length of DNA that tells bacteria that possess it how to deal with many common antibiotics – antibiotics that few bacteria could resist until now. (A ring of DNA that sits within a bacterial cell like this is called a plasmid).

Let's talk about sex. By and large, bacteria reproduce by splitting in two. No mummies or daddies, storks or mulberry bushes – they just make a copy of all their DNA and split into two identical cells. Bacteria do not usually reproduce sexually (that is, where two organisms 'mate' and share their DNA in the way that animals do) BUT bacteria have developed handy trick over millennia of evolution. Bacteria have a system where they can swap plasmids of DNA like NDM1 with each other. It's rather like trading football cards – but this particular card contains the information the cell needs to resist a number of 'last resort' antibiotics.

NDM1 uses this method to transfer between different species of bacteria. So, NDM1 isn't a superbug itself but it can turn various species of formerly harmless bacteria into superbugs.

Bacteria Isolated with NDM1

So far NDM1 has been isolated in *Klebsiella pneumoniae*, *E. coli* and other *Enterobacteriaceae*. NB *Salmonella*, *Shigella* and *Yersinia* are also part of this group but NDM1 has not been isolated in any of these in the UK yet. Remember - the other thing all these bacteria have in common is that they are easily killed by Chemex products.

Antibiotic Resistance

The NDM-1 gene works by producing an enzyme that safeguards bacteria against β -lactam antibiotics – the broad class of antibiotics that includes penicillin. β -lactam is a ring-shaped chemical which interferes with the bacterial cell wall and halts the replication of bacteria. The enzyme coded by NDM1 breaks this ring, rendering the antibiotic ineffective. There are other β -lactam antibiotic-resistant bacteria that have genes that work in the same way – but they have not developed the knack of sharing this gene with other species of bacteria. NDM1 is promiscuous. It doesn't stick to a single species.

Many infections that prove resistant to the 'usual' antibiotics are often treated with carbapenems - antibiotics which have the broadest action and the lowest resistance rates – hence they tend to be used when all else fails.

Other bacteria have been known to produce similar enzymes, but only a few UK cases have been

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resistant to carbapenems - and these have not been able to transfer this resistance to other bacteria.

Chemicals

Antibiotics are sophisticated and subtle things that use very elegant biochemistry to kill bacteria without damaging host cells. The biocides we use are very safe to humans but are really very unsubtle in the way they kill bacteria.

We can become resistant to disease just like bacteria can become resistant to antibiotics, but the idea that any bacteria can become resistant to the biocides we use is similar to the notion that we could become resistant to being shot in the head with a rather large gun. The biocides we use work in a very different way to antibiotics. Subtle they ain't.

Summary

NDM1 is not a superbug. It is a sequence of DNA that allows multiple species of different bacteria to become resistant to antibiotics that few bugs were able resist – until now.

NDM1 does NOT confer resistance to the biocides in Chemex products. The usual products will kill bacteria containing the NDM1 plasmid on contact.

Please reassure your customers and call the Technical Department if you have any questions.



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